

Intraoral radiographs for the diagnosis, treatment, and follow-up of periodontal disease: Position paper from the Canadian Dental Hygienists Association.

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Study Guide: Intraoral Radiographs in Periodontal Disease Management

This study guide is based on the Canadian Dental Hygienists Association (CDHA) position paper and systematic review regarding the use of intraoral radiographs for the diagnosis, treatment, and follow-up of periodontal disease.

Key Concepts and Review Summary

1. The Role of Intraoral Radiographs

Intraoral radiographs—specifically periapical and bitewing images—are standard-of-care tools used to supplement clinical evaluations. They provide critical data on bone defects, the extent and severity of bone loss, furcation involvement, and underlying pathologies that clinical examinations alone might miss.

2. Diagnostic Accuracy and Sensitivity

A systematic review of 30 studies involving 1,645 adult patients revealed the following:

- **Sensitivity:** Intraoral radiographs demonstrate a moderate to high sensitivity (60% to 90%) for identifying periodontitis and peri-implantitis bone loss.
- **Underestimation of Bone Loss:** Radiographs typically underestimate alveolar bone loss by **0.5 mm to 2.8 mm** when compared to direct measurements (such as flap surgery) or clinical attachment level (CAL) measurements.
- **Association:** There is a moderate association ($r = 0.5$ to 0.8) between clinical measurements and radiographic findings.

3. Comparison of Imaging Modalities

The document compares intraoral radiographs to other common imaging techniques:

Modality	Accuracy vs. Intraoral Radiographs	Notable Limitations/Benefits
Panoramic Radiographs	Less accurate; higher underestimation (24% vs. 13% for intraoral).	Subject to magnification, superimposition, and lower spatial resolution.
CBCT (3D Imaging)	Comparable level of accuracy (CBCT = 0.62; Intraoral = 0.59).	Higher radiation dose and cost; subject to artifacts (beam hardening/scattering).
Vertical Bitewings	Superior for moderate to advanced bone loss.	Better visualization of both maxillary and mandibular bone levels simultaneously.

4. Professional Scope and Clinical Application

- **Clinical Adjunct:** Radiographs are not standalone diagnostic tools; they must be used alongside medical history, clinical examinations (probing/CAL), and previous imaging.
- **Paralleling Technique:** This is the preferred method for periapical radiographs to minimize distortion.
- **Canadian Scope of Practice:** While all dental hygienists in Canada are expected to interpret radiographs, the authority to *prescribe* them varies by province and territory (e.g., permitted in Alberta and British Columbia, among others).

Short-Answer Practice Quiz

1. According to the CDHA position paper, what is the reported sensitivity range of intraoral radiographs for assessing periodontal bone loss? *Answer:* 60% to 90%.

2. By how much do intraoral radiographs typically underestimate bone loss compared to clinical methods? *Answer:* Between 0.5 mm and 2.8 mm.

3. Why are vertical bitewings specifically recommended for patients with moderate to advanced periodontal disease? *Answer:* They improve the likelihood of visualizing both mandibular and maxillary bone levels and provide better accuracy in detecting furcation involvement compared to horizontal bitewings.

4. How does the accuracy of intraoral radiographs compare to panoramic radiographs in assessing bone loss? *Answer:* Intraoral radiographs are more accurate; studies showed they underestimated bone loss by 13%, while panoramic radiographs underestimated it by 24%.

5. Is Cone-Beam Computed Tomography (CBCT) recommended for routine periodontal assessment? Why or why not? *Answer:* No. While it has similar accuracy to intraoral radiographs, its higher radiation dose, higher cost, and susceptibility to artifacts make it unsuitable for routine use.

6. Which radiographic technique is preferred for periapical images to ensure the least distortion of periodontal structures? *Answer:* The paralleling technique.

7. What is the "diagnostic yardstick" for periodontitis according to the reference standards mentioned? *Answer:* Clinical attachment loss (CAL).

8. Name three subgingival findings that intraoral radiographs help identify which may be missed by clinical exam alone. *Answer:* (Any three) Furcation involvement, root resorption, local irritating factors (calculus), caries, and periapical pathology.

9. How many dental hygiene governing bodies in Canada currently include the prescription of radiographs within the dental hygienist's scope of practice? *Answer:* Seven (Alberta, British Columbia, New Brunswick, Nova Scotia, Newfoundland and Labrador, Prince Edward Island, and Northwest Territories).

10. What effect does demineralization have on radiographic measurements in peri-implantitis cases? *Answer:* It can negatively influence the accuracy of radiographic measurements, often leading to the underestimation of bone loss.

Essay Questions for Deeper Exploration

- 1. The Complementary Nature of Diagnostics:** Explain why intraoral radiographs are considered an "adjunct" rather than a standalone tool in periodontal diagnosis. Discuss the risks associated with relying solely on either clinical probing or radiographic imaging.
 - 2. Comparative Radiography:** Compare and contrast 2D intraoral imaging with 3D CBCT in the context of periodontal therapy. Discuss factors such as radiation safety (ALARA), cost-effectiveness, and diagnostic limitations like "beam hardening artifacts."
 - 3. Clinical Translation and Technique:** Describe the impact of radiographic technique (e.g., paralleling vs. bisecting angle, and horizontal vs. vertical bitewings) on the accuracy of alveolar bone loss measurements. Why is standardization of these techniques vital for monitoring disease progression over time?
 - 4. Professional Regulation and Patient Outcomes:** Discuss how variations in the scope of practice for dental hygienists across Canadian provinces might impact patient care. Argue for or against the necessity of dental hygienists having the authority to prescribe radiographs based on the evidence provided in the CDHA position paper.
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Glossary of Important Terms

- **Alveolar Bone Loss:** The loss of the bone that supports the teeth, a primary indicator of periodontal disease severity.
- **Bitewing Radiograph:** An intraoral image used primarily to detect interproximal decay and monitor the height of the alveolar bone.

- **Clinical Attachment Level (CAL):** A clinical measurement of the position of the gingiva in relation to the cemento-enamel junction (CEJ); the primary indicator of periodontal destruction.
- **Cone-Beam Computed Tomography (CBCT):** An advanced 3D imaging modality that provides a volumetric representation of the maxillofacial area.
- **Furcation Involvement:** Bone loss occurring at the point where a tooth's roots branch out, often difficult to detect without radiographs.
- **Paralleling Technique:** An intraoral radiographic technique where the image receptor is placed parallel to the long axis of the tooth to produce an accurate, non-distorted image.
- **Peri-implantitis:** An inflammatory condition affecting the tissues around dental implants, resulting in the loss of supporting bone.
- **Periapical Radiograph (PA):** An intraoral image that shows the entire tooth from the crown to the end of the root and the surrounding bone.
- **Sensitivity:** In diagnostics, the ability of a test to correctly identify those with the disease (true positive rate).
- **Specificity:** In diagnostics, the ability of a test to correctly identify those without the disease (true negative rate).
- **Standard of Care:** The level of care and skill that is expected of a professional in a given situation, in this case, using radiographs to supplement periodontal evaluation.